

The Identity of *Culex (Melanoconion) taeniopus* Dyar and Knab and Related Species with Notes on the Synonymy¹ and Description of a New Species (Diptera, Culicidae)

S. Sirivanakarn² and John N. Belkin³

ABSTRACT. To resolve problems of identity and synonymy of *Culex (Melanoconion) taeniopus* Dyar and Knab 1907, *epanastasis* Dyar 1922, *crybda* Dyar 1924, *opisthopus* Komp 1926 and *pseudotaeniopus* Galindo and Blanton 1954, a detailed study and comparison of the types and other identified specimens at the U. S. National Museum, and a critical review of the original and subsequent descriptions have been made. As a result of this study, the following actions are taken to stabilize the nomenclature: (1) synonymy of *opisthopus* with *taeniopus*, (2) synonymy of *pseudotaeniopus* with *epanastasis*, (3) resurrection of *crybda* from the synonymy of *epanastasis* and (4) recognition and description of *pedroi* n. sp. for the Panamanian population previously called *taeniopus* Dyar and Knab by Galindo (1969). A summary of important diagnostic features of the adults and male genitalia of the above species are presented in provisional keys. All stages of *pedroi* are described and illustrated and its distribution and bionomics are summarized.

INTRODUCTION

Recent study of the type-specimens and other identified material of medically important species of *Culex (Melanoconion)* related to *taeniopus* Dyar and Knab 1907, has revealed differing usage and misidentification of many species in the group. A general background of the biology, taxonomy and the relationships of the species involved was reviewed by Galindo (1969) who provisionally assigned 10 species to a group recognized as "the *Culex spissipes* group." Of greatest concern among the closely related nominal species (valid or synonyms) placed within this group are the true identity and the subsequent interpretations and descriptions of the following nominal taxa: *taeniopus*, *epanastasis* Dyar 1922, *crybda* Dyar 1924, *opisthopus* Komp 1926 and *pseudotaeniopus* Galindo and Blanton 1954. The names *taeniopus* and *opisthopus* were widely used for 2 distinct taxa with distinctive male genitalia as described and figured in Dyar (1928). This definition of *taeniopus* by Dyar has been accepted and consistently followed by practically all subsequent authors, including Rozeboom and Komp (1950:96). The latter suggested that *taeniopus* from Nicaragua may be the same as *opisthopus* from Honduras. Subsequently, at various times since Dyar's monograph, 2 other

¹This work was supported by Research Contracts DAMD-17-74-C-4086 and DA-49-193-MD-2478 from the U. S. Army Medical Research and Development Command, Office of the Surgeon General, Fort Detrick, Frederick, MD 21701 and U. S. Public Health Service Research Grant AI-04379.

²Medical Entomology Project, Smithsonian Institution, Washington, D. C. 20560.

³Mosquitoes of Middle America Project, Department of Biology, University of California, Los Angeles, CA 90024.

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 1980		2. REPORT TYPE		3. DATES COVERED 00-00-1980 to 00-00-1980	
4. TITLE AND SUBTITLE The Identity of Culex (Melanoconion) taeniopus Dyar and Knab and Related Species with Notes on the Synonymy and Description of a New Species (Diptera, Culicidae)				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Medical Entomology Project, Smithsonian Institution, Washington, DC, 20560				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT see report					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 18	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

nominal taxa, *epanastasis* and *crybda*, which have male genitalia similar or identical to those of the males associated with *taeniopus* by Dyar (1928), were subject to confusing taxonomic changes. These included the synonymy of *crybda* with *taeniopus* by Dyar (1928:293), followed by the synonymy of *epanastasis* with the latter by Komp (1935:4). Later, Rozeboom and Komp (1950:89) resurrected *crybda* and restricted the name *crybda* to the form with completely dark legs or absence of tarsal markings. Finally, Galindo (1969:87), based on the original and subsequent descriptions of Dyar (1922, 1928), resurrected and reinterpreted *epanastasis* as having completely dark legs and synonymized *crybda* with this species. Contributing further to a complication of the nomenclature of these taxa was the description of *pseudotaeniopus* by Galindo and Blanton (1954:240-2). Until recently, the validity of *pseudotaeniopus* was questionable as it was distinguished only on the basis of differences in the male genitalia with the figures of *taeniopus* in Dyar (1928) and Rozeboom and Komp (1950).

In our present attempt to resolve the above problems, we have carefully studied the types, the original and pertinent subsequent descriptions of these taxa and compared them in detail with other available topotypic material, including specimens previously identified by Dyar and other early workers. This study revealed more serious fundamental problems that have remained unsolved since the original description of *taeniopus* and *epanastasis* whose types have apparently never been thoroughly examined or closely compared with the types of other nominal taxa or with other specimens to which these names were applied. This problem is most acute in the case of *taeniopus* which was originally described only from a female collected in Nicaragua and was later associated with superficially similar males from Venezuela and Panama by Dyar (1928). As fully discussed below, a critical comparison of the *taeniopus* type with the Venezuelan and Panamanian specimens identified as "*taeniopus*" by Dyar and other workers has shown that there were misidentifications and error in the association of sexes of this taxa during Dyar's time. A similar problem has also been encountered in the case of *epanastasis* which was described from a male in extremely poor condition with poorly mounted genitalia. To resolve these and other related problems, we have made a special effort to determine the identity of the types of all the above nominal taxa. In conclusion, a discussion on the newly proposed synonymy, recognition and description of a new species and a summary of the diagnostic characters of the adults, including the male genitalia of the taxonomically valid species as determined here are given.

IDENTITY OF THE TYPES WITH AN ANALYSIS OF THE ORIGINAL AND SUBSEQUENT DESCRIPTIONS

Culex taeniopus Dyar and Knab 1907. The description of *taeniopus* by Dyar and Knab (1907:100-1) was based on a single holotype female collected from Bluefields, Nicaragua. The type bears the following labels: // Dr. W. F. Thornton // Bluefields, Nicar. // # 19 // USNM 10260 // *Culex taeniopus* D & K / type //. Except for specific detail, the original description generally agrees with the type. The only significant diagnostic feature given was the presence of tarsal markings on the legs. This was stated as follows, ". . . legs black, with broad white rings on the tarsi, involving

both ends of the joints, the last tarsal joint wholly white". This feature is restricted to the banding pattern on tarsal segments 1 to 5 of the hindleg, as mentioned in the subsequent descriptions in Howard, Dyar and Knab (1915:248-9) and Dyar (1928:293-4). In addition to the characteristic tarsal markings of the hindleg, we also found 2 other features in the *taeniopus* type, which are significant in determining the identity of this species. These include the presence of a small patch of 3 or 4 broad pale scales on the upper corner of the sternopleuron and the absence of broad white knee spots on the apices of all femora. However, in the subsequent descriptions by Howard, Dyar and Knab and Dyar, only the tarsal markings were used in the diagnosis of *taeniopus* and none of the latter 2 features were mentioned. On the other hand, these subsequent descriptions were composite, based on the mixture of the specimens from Panama, Colombia, Venezuela and elsewhere, including also the unique type from Nicaragua. Consequently, the descriptions of the adults were more or less modified with the statements on the characteristic tarsal markings of the hindleg and other additional features. Among the latter, the most significant is the description of the apex of the femora. In Howard, Dyar and Knab, it was stated, ". . . knees broadly silvery white", and in Dyar, ". . . tips of femora and bands involving both ends of the joints white". Both of these descriptions clearly indicate the presence of broad white knee spots on the apices of the femora of the legs. This feature does not agree with the *taeniopus* type. In examining adults of both sexes identified as *taeniopus* by Dyar and others at the USNM, we found them with broad white knee spots. None of these specimens exhibited scales or a scale patch on the upper corner of the sternopleuron as noted in the *taeniopus* type. This indicates that the specimens from Panama, Venezuela and Colombia described as *taeniopus* in Howard, Dyar and Knab (1915) and Dyar (1928) were all misidentified and that the male with the characteristic genitalia described and figured as *taeniopus* by Dyar (1928), Bonne and Bonne-Wepster (1925:296-8) and others is not correctly associated and cannot be accepted in the interpretation of this nominal species.

In summary, the true identity of *taeniopus* adults as determined above are confirmed by the following significant features: (1) presence of tarsal markings or pattern of white bands at the joints of tarsomeres 1-5 of the hindleg; (2) presence of scales or a small scale patch on the upper corner of the sternopleuron and (3) absence of the broad white knee spots on the apex of the femora of all legs. With respect to the specimens previously misidentified as *taeniopus*, we believe they represent an undescribed taxon which we describe later in this paper.

Culex opisthopus Komp 1926. The original description of *opisthopus* by Komp (1926:44-5) was based on 2 males and 3 females collected from Puerto Castilla, Honduras. The type-series, including the male lectotype designated by Stone and Knight (1957:54) are in very good condition. The male lectotype bears the following labels: // 2177 // PTO Castilla R. Hond. / III-1925 / W. H. W. Komp coll. // Lectotype / A. Stone and K. L. Knight 1957 //. In Komp's original description of the adults and the subsequent description with figure of the male genitalia by Dyar (1928:294-5), the only significant diagnostic feature given was the presence of the hind tarsal markings. All other general features in these descriptions agree well with the type-specimens in all aspects except for the obscure statement in Komp's description indicating the presence of white tips at the apex of the femora.

This feature is not conspicuous in Komp's type-series except at the extreme apex of the hindfemur which may or may not be visible among different specimens in the type-series. The other significant feature which was not mentioned either by Komp or Dyar is the presence of a small scale patch on the upper corner of the sternopleuron in all adults of the *opisthopus* type-series. In comparing these specimens with the female type of *taeniopus*, we found that they are exceedingly similar in all general features, including most importantly, the presence of a scale patch on the upper corner of the sternopleuron, the absence of the broad white knee spots on the apex of all femora and the presence of the hind tarsal markings. This strongly suggests that both nominal taxa are identical. The male genitalia of the *opisthopus* type (lectotype) generally agree with the figure in Dyar and fit perfectly well with Fig. 61 in Rozeboom and Komp (1950:108) as well as with Fig. 37 for the Jamaican population of this species in Belkin, Heinemann and Page (1970:82-4). These structures are distinct from the misidentified specimens of *taeniopus* in Dyar (1928) noted above and from *epanastasis*, *crybda* and *pseudotaeniopus* discussed below. In summary, we believe the type-specimens of *opisthopus* belong to the same taxon as the type of *taeniopus* Dyar and Knab and the male genitalia are as illustrated by Rozeboom and Komp (1950) and Belkin, Heinemann and Page (1970).

Culex epanastasis Dyar 1922. The description of *epanastasis* by Dyar (1922:1912) was based on a single holotype male with slide of the genitalia from the Arenal River, Toro Point, Canal Zone, Panama. The type on a pin bears the following labels: // Toro Point CZ / 1922 // July 19 // J. B. Shropshire Coll. // 1710 // USNM 25761 // XXI 3 //. The type is in extremely poor condition, as indicated by Dyar, both hindtarsi are missing, leaving only the femora and parts of the tibiae; one each of the fore- and midlegs are still present but the rest are broken off at the femora-tibial joints; both palpi are broken off at the base of segment 2, leaving one of the broken parts entangled among the filaments of the antennae. Other features, including the scales and setae on the head and mesonotum are mostly rubbed off and the abdominal segments are much shrunken. The male genitalia are still in good condition but were poorly mounted. Both the original and subsequent descriptions by Dyar (1922; 1928:296-7) are essentially similar, limited only to the general features that were present in the type. Of particular significance is the description of the legs which states, "Legs black, the femora narrowly pale beneath, tips of femora distinctly white". This description clearly indicated that there were broad white knee spots on the apex of the femora of all legs which has been confirmed in the type. Another feature which also appears to be significant in the description by Dyar is the length of the palpus which was stated to have been fully as long as the proboscis. This seems to be the case, judging from the relatively short segments 4 and 5 of the broken part of the palpus which was entangled among the antennal filaments. In addition, we also noted a broad white scaled band at the base of segment 2 in the type. The male genitalia associated with the type, which we dissected and remounted obviously do not agree with the figure in Dyar (1928) and the figure for "*taeniopus*" by Rozeboom and Komp (1950) in certain significant details. These include especially the shape of the lateral plate of the aedeagus and the arrangement of the setae on the distal division (= outer division in Rozeboom and Komp

1950) of the subapical lobe. In comparing these structures with the types of other taxa related to *taeniopus*, we found that they are identical to those of *pseudotaeniopus* Galindo and Blanton (1954:240-2) but not to *crybda* Dyar or "*taeniopus*" of Dyar. Other features of the *epanastasis* type, including the white bands on palpal segment 2, the relatively short palpus and the presence of the broad white knee spots on the apex of the femora that are still present are similar to the type of *pseudotaeniopus*. The above data strongly suggest that *epanastasis* and *pseudotaeniopus* are most probably conspecific.

Culex pseudotaeniopus Galindo and Blanton 1954. This nominal species was described from a number of specimens collected and reared from Mojinga Swamp, Canal Zone and Cerro Jefe in Panama. We have examined the holotype male and its genitalia mounted on the same slide and other paratypes at USNM, including 1 male on pin with slides of genitalia and associated larval and pupal skins, 2 slides of male genitalia, 1 slide of associated larval and pupal skins (adult lost) and 3 slides of larval skins. The original description and the figures of the male genitalia, pupal trumpet and part of larval chaetotaxy by Galindo and Blanton (1954:240-2) agree with all specimens in the type-series. The most diagnostic features of the adult male of *pseudotaeniopus* from specimens in the type-series are: (1) presence of distinct pale bands at the bases of palpal segments 2-5; (2) absence of a scale patch on the upper corner of the sternopleuron; (3) presence of broad white knee spots on apex of all femora and (4) presence of tarsal markings on the hindleg. The male genitalia of *pseudotaeniopus* are essentially similar to the above type of *epanastasis*, but are distinct from *opisthopus* and "*taeniopus*" of Dyar (1928) in the arrangement of the specialized setae on the distal division of the subapical lobe and in the relatively short tergal and sternal spines on the apical portion of the lateral plate of the aedeagus. As indicated above, this nominal taxon and *epanastasis* are probably conspecific.

Culex crybda Dyar 1924. This nominal species was described from a holotype male collected in Colombia. The type on a pin is in perfect condition. It bears the following label: // Murindo, Colombia // L. H. Dunn Coll. 1996 // USNM // *Culex* (*Choeroporpa*) *crybda* Dyar / Type //. The original description by Dyar (1924:184) was brief and generally agrees with the type. In the description of the leg, the only statement given was "tarsi dark". As determined earlier by Rozeboom and Komp (1950) and confirmed here, this statement indicates that there are no tarsal markings on the hindleg in the *crybda* type. In addition, we also found that it is different from the type-specimens of *epanastasis*, *pseudotaeniopus* and the specimens misidentified with *taeniopus* by Dyar (1928) as determined above in the absence of the broad white knee spots on the apex of all femora of the legs and from the true *taeniopus* type in the absence of a scale patch on the upper corner of the sternopleuron. The male palpus of the *crybda* type also differs from those of *epanastasis* and *pseudotaeniopus* in the absence of pale bands at the bases of segments 2 to 5. The male genitalia of are identical to those of "*taeniopus*" of authors as figured in Dyar (1928) and Rozeboom and Komp (1950) but are different from *epanastasis* and *pseudotaeniopus*. On this basis, we consider *crybda* Dyar as a distinct valid taxon.

The above analysis shows that there were fundamental errors in earlier interpretations of the identity of *taeniopus* and *epanastasis*. Consequently, all previous attempts at the synonymy of *taeniopus*, *crybda* and *epanastasis* were incorrect. Because of the misidentification of the adults and erroneous association of the male of *taeniopus* by Dyar and others, the description and figure of the male genitalia for this species in Dyar (1928) cannot be accepted as a basis for determining the identity of *taeniopus*. A recent study of extensive additional material, previously identified with or known as *taeniopus* according to the description and figure of the male genitalia of Dyar (1928), has shown that these populations represent an undescribed species. A detailed study of the holotype male of *epanastasis* and its remounted genitalia has also shown that it is distinct from *crybda* and that the previous synonymy of these nominal taxa by Galindo (1969) is erroneous.

Based on this evidence, we propose to recognize the Panamanian population, previously known as *taeniopus* as *pedroi* new species. To stabilize the nomenclature, *opisthopus* is synonymized with *taeniopus*, *pseudotaeniopus* is synonymized with *epanastasis* and *crybda* is recognized as a valid taxon and is resurrected from its synonymy with *epanastasis*. A summary of the significant diagnostic features of the adults, including the male genitalia, of *taeniopus*, *epanastasis*, *crybda* and *pedroi*, are presented in the provisional keys following the description of *pedroi*.

DESCRIPTION OF *CULEX* (MELANOCONION) *PEDROI* NEW SPECIES (Figs. 1-4)

Culex taeniopus in part of Howard, Dyar and Knab (1915:248-9).

Culex (*Choeroporpa*) *taeniopus* in part of Dyar (1920:54; 1923:178);

Bonne and Bonne-Wepster (1925:296-8).

Culex (*Mochlostyrax*) *taeniopus* in part of Dyar (1925:171; 1928:293-4).

Culex (*Melanoconion*) *taeniopus* in part of Edwards (1932:213); Komp (1935:4); Rozeboom and Komp (1950:96-7); Lane (1953:402-3); Foote (1954:92); Galindo and Blanton (1955:72); Stone, Knight and Starcke (1959:275); Forattini (1965:184-5); Knight and Stone (1977:265).

Culex (*Melanoconion*) *taeniopus* of Duret (1953:69, 70, 71, 72, 75; 1954:102-3); Galindo (1969: 82-9).

FEMALE (Fig. 1). Wing: 3.2 mm. Proboscis: 1.8 mm. Forefemur: 1.44 mm. Abdomen: 2.2 mm. Medium sized species, general coloration dark brown to almost black with broad white knee spots on apex of femora of all legs and a striking pattern of white rings on hindtarsus. *Head*. Decumbent scales of vertex narrow, numerous, occupying an extensive area in center, color dark at middle, pale whitish on lateral and posterolateral areas; broad appressed scales all restricted to sides of eyes, pale whitish or grayish, forming a distinct lateral patch; erect scales numerous, coarse, entirely blackish. Palpus dark scaled, apparently 3-segmented, length about 0.13 of proboscis. Proboscis dark scaled on labium, longer than forefemur. *Cibarial Armature* (Fig. 3). Cibarial bar broad, concave; cibarial teeth about 10, all large, flat, columnar, with distinct hollow or transparent area occupying most of the proximal portion of median teeth; apical margin of teeth weakly serrate

or denticulate; cibarial dome hemispherical, strongly indented and denticulate. *Thorax*. Mesonotal integument chestnut brown to nearly black; scales numerous, relatively coarse, entirely dark brown or blackish on disc, prescutellar space and scutellar lobes; acrostichal setae not developed on disc; dorsocentral setae very strong, entirely blackish. Pronotum same color as mesonotum; *apn* with 2, 3 strong and 10 other weak setae on dorsolateral surface; *ppn* with a patch of narrow dark scales on anterior upper surface and 5, 6 posterior setae. Pleuron uniformly dark brown, without definite pattern of lighter areas; scales or scale patches absent on all sclerites except for a few or more dark scales loosely forming a patch along lower posterior border of *stp*; posterior margin of *stp* with a characteristic even row of at least 20 dark setae extending from the upper corner along lower posterior border to level of midcoxa; one lower *mep* seta present; upper *mep* setae 10-12. *Legs*. Apex of all femora with broad silvery white knee spots; hindtarsus with broad silvery white rings at joints of tarsomeres 1-4; tarsomere 1 also with distinct basal white band; tarsomere 5 completely white, remainder of legs entirely dark. *Wing*. Scales moderately dense and entirely dark; plume scales on veins R₂, R₃ and R₄₊₅ and branches of M broad, ovate. *Abdomen*. All tergites entirely dark on dorsal surface, lateral surface with broad basolateral pale spots; sternites with basal transverse pale bands. *Genitalia* (Fig. 3). As figured, not studied in detail.

MALE (Fig. 1). In general as described for female. *Head*. Palpus long, slender, entirely dark scaled, exceeding proboscis length by about the combined length of segments 4 and 5; apex of segment 3 with 5, 6 strong setae; segments 4 and 5 strongly plumose. Antennal flagellum strongly plumose. *Abdomen*. Tergites I, II entirely dark; tergites III-VII with narrow or broad basal transverse pale bands.

MALE GENITALIA (Fig. 2). *Segment VIII*. Median caudal margin of tergite VIII shallowly or moderately emarginate. *Segment IX*. Lobes of IX tergite small, moundlike, widely separate, bearing 2, 3 irregular rows of 10-12 fine setae. *Sidepiece*. Slender, conical, about 0.28 mm in length; several scales present near base on lateral tergal surface, latter broadly convex on outer margin, with about 20 strong and several other weak setae extending from near base to apex; tergomesal margin slightly concave, with 1, 2 irregular rows of about 10 short weak setae extending from near middle to the base of proximal division of subapical lobe; inner tergal surface laterad of tergomesal margin with 2 strong setae at about middle of slightly swollen area and several weak short setae cephalad. *Subapical Lobe*. Well developed, composed of 2 large, elongate stemlike proximal and distal divisions, projecting mesad; proximal division not divided or furcate, with 2, 3 short, more or less flattened setae at base, one strong, hooked seta beyond middle and 2 stout curved rods (*a*, *b*) and one broad, triangular sheathlike seta on apex, latter more or less attached to basal portion of rod *b* dorsad; distal division with one long fine seta (*h*) at base of proximal stem distad, latter distally divided into 2 divergent stalks, the proximal of which bears one long, stout, apically hooked rod and 2 shorter acute blades, the distal of which bears one long, distally bent, pointed rod and 3, 4 closely packed, apically blunt foliiforms. *Clasper*. Simple, about 0.75 of sidepiece, uniformly thick from base to slightly beyond median curvature,

preapical portion tapered into a recurved truncate apex or snout; crest of fine spicules on outer margin of preapical portion absent or poorly developed; seta *a* distally broad, with rounded or truncate apical margin; seta *b* fine, hairlike, very distinct; seta *c* rather inconspicuous.

Phallosome. Lateral plates of aedeagus connected by a broad lower tergal bridge; upper tergal bridge absent; lateral plate in lateral aspect with a broadly sclerotized basal hook, projecting sternad; apical portion of lateral plate with a long, beaklike apical tergal process and a short, apically pointed and hooked apical sternal process. *Proctiger*. Apical crown dark, comblike, composed of a close-set row of 8,9 flattened apically blunt spicules; paraproct and cercal sclerite narrow; cercal setae 2,3; basolateral sclerotization broad, somewhat triangular in outline.

PUPA (Fig. 3). Abdomen 2.8 mm. Trumpet 0.65 mm. Paddle 0.70 mm. Complete chaetotaxy as figures. Pigmentation of integument light brown or infuscate with brownish tinge not forming definite pattern. *Cephalothorax*. All setae weak except 8,9-C; 1,3,6-C single; 2-C 3,4 branched; 4,7,9-C double; 5-C double or triple, subequal to 4-C; 8-C usually double, sometimes single or more branched. *Trumpet*. Brownish, long, sinuous in outline, median portion slightly swollen, narrow toward base and apex; pinna small, continuous with a characteristic cleft or slit to about middle of trumpet length. *Metanotum*. Seta 10-C 10-16 branched; 11-C double; 12-C triple. *Abdomen*. Setae 3-I,II double; 3-III single or double; 1-II brushlike, 20-24 branched; 1-III 5-8 branched; 1-IV 7 branched; 1-V 4,5 branched; 1-VI 3,4 branched; 1-VII double or triple; 5-IV-VI subequal to 1-IV-VI; 5-IV 5-8 branched; 5-V 4,5 branched; 5-VI double or triple; 6-III-VI double, all subequal; 9-VII usually double (2,3); 9-VIII double or triple, placed at or very near to caudolateral angle of segment VIII. *Paddle*. Broad, oval, light brown or same color as abdomen; midrib strong and dark; setae 1,2-P minute, subequal.

LARVAE (Fig. 4). Head 0.85. Siphon 1.7 mm. Saddle 0.36 mm. Complete chaetotaxy as figured. *Head*. Integument light brown, with a lighter transverse band running across dorsal and ventral surfaces of ocular bulge; color dark brown. Seta 1-C dark, spiniform; 3-C minute, distinct, situated nearer to dorsal midline than 1-C; 4-C forked into 2 or more branches, its length about as long as distance between bases of the pair; 5-C strong, with 5-8 pectinate branches; 6-C single, 2.0 length of 5-C; 7-C length of 5-C, 8-10 branched. Antenna dark brown along the entire shaft; spicules strong, numerous; seta 1-A large, fan-shaped, with about 20 strongly plumose branches; 2,3-A strong, dark, bristle-like, apical or nearly so. Mental plate with 6,7 lateral teeth on each side of median tooth. *Thorax*. Pigmentation in whole mounted specimens dark greenish or bluish; spiculation absent or poorly developed; setae 1,2,4, 5-8-P strong; 1,2,5,6-P single; 3-P reduced, 4-6 branched; 4-P triple; 7-P 5,6 branched; 8-P usually 4 branched (4-6); 1-M,T minute, single and rather inconspicuous; 8,9-M 7 branched; 7-T 10 branched; 9-T 7 branched; 13-T 6-9 branched. *Abdomen*. Color in whole mounted specimens same as thorax; setae 6-I,II triple, median branch weaker and shorter than the other 2 lateral branches; 7-I double; 1-I,II minute, single, rather inconspicuous; 1-III-IV strong, 4-6 branched; 6-III-VI 4,5 branched; 1-VII 6-8 branched; 4-VII 5 branched; 7,10-VII 4 branched; 1-VIII 7 branched; 2-VIII double; 3-VIII 9 branched; 4-VIII single; 5-VIII 6

branched; comb scales 40-50, subequal, in broad oval patch, apical fringe with evenly fine spicules. *Siphon*. Long, slender, distally tapered, index 10 or more; acus and extreme base dark brown, distal portion usually with a broad median dark ring, the remainder yellowish or light brown; pecten teeth 9-12, larger distal teeth with distinct basal denticle and an inconspicuous fringe of numerous delicate spicules; subventral tufts 4 pairs (total 8), widely spaced from beyond pecten to about 0.75 of total length; each tuft 4,5 branched, first 1,2 proximal tufts 1.0-1.5 as long as siphonal width at points of insertion, the other 2 tufts gradually shorter; dorsolateral tufts 2 pairs, minute; more proximal pair double, placed at 0.75 of the length from base; more distal pair single, placed near to apex; seta 2-S moderately developed, apically hooked and with one submedian spine; median caudal filament of spiracular apparatus well developed, moderate in length. *Anal Segment*. Saddle brownish; posterior caudal margin weakly spiculate, seta 1-X 4,5 branched; 2-X with 1,2 long and 3-5 short branches; 4-X with 6 pairs of strong, branched setae; anal gills slender, fusiform, slightly longer than saddle.

TYPE DATA. *Holotype* ♂ (PA 1126-104) with associated pupal skin and genitalia slides, Chilibre, Rio Chagres, about 0.5 km S of Juan Mina (17 PPA 4712), elevation 25 m, Canal Zone, PANAMA, 18 July 1972, J. Hal Arnell and R. Hinds (USNM # 76339). *Allotype* ♀ (PA 1126-102) with slide of associated pupal skin, same data as holotype (USNM). *Paratypes*: 2p♂ (PA 1126-107,109) with slides of genitalia; 3 ♂ (PA 1126-70, 106, 110); 3p♀ (PA 1126-108, 111, 114); 20 whole larvae, 4 pupae (incomplete), same data as holotype, (BMNH, GML, USNM). This species is named in honor of Pedro Galindo for his numerous important contributions to the taxonomy, ecology and medical importance of the subgenus *Melanoconion*.

DISTRIBUTION. Widespread from Tabasco in Mexico southwards to Corrientes in Argentina. 466 specimens examined: 251 ♂, 160 ♀, 44 L, 11 P; 22 individual rearings (10 pupal, 12 larval).

MEXICO. *Tabasco*: Cardenas, "Colegio Superior de Agricultura Tropical", 20 mm, 15 Jul 70, D. & K. Schroeder (MEX 564), 2 ♀ (USNM).

COSTA RICA. *Limon*: Finca La Lola, 26 Nov 62, R. Casebeer, 1 ♂. 7 ♀ (USNM). *Heredia*: Puerto Viejo, Finca La Selva, 5 Jul 75, J. Haye (CR 614), 3 ♂ (USNM).

PANAMA. *Canal Zone*: localities not specified, 1963-64, W. P. Murdoch (CZ 261), 1 ♂, 3 L (USNM); (PAX 22, 39, 41, 209), 41 ♂, 21 ♀ (USNM); W. H. W. Komp (KO 11-16-37), 1 ♀ (USNM). Chilibre, Rio Chagres (type locality), 18 Jul 72, J. Hal Arnell and R. Hinds (PA 1126), 6p♂ (PA 1126-70, 104, 106, 107, 109, 110), 4p♀ (PA 1126-102, 108, 111, 114), 4 P, 20 L (USNM). *Bocas del Toro*: Almirante, Milla 2, 10 m, Apr-Apr, 63-64, A. Quinonez (PA 278, 338, 340, 663, 666, 667, 671), 3 ♂, 12 ♀ (USNM); Gorgas Memorial Lab, 1 lp ♂ (CM 263-117) (USNM); *Panama City*: Pedregal, near Tocumen, 11 Sept 63, A. Quinonez (PA 553), 1 ♀ (PA 553-129) (USNM).

COLOMBIA. *Santander*: Lebrija, 10 Apr 66, C. J. Marinkelle (COM 64A), 10 ♀ (USNM); *Caqueta*: Tres Esquinas, 8 Aug 70, C. J. Marinkelle (COM 494), 2 ♀ (USNM); *Boyaca*: Puerto Boyaca, 25 Nov 70, C. J. Marinkelle (COM 496), 5 ♀ (USNM); 1 Sept 71, (COM 604), 1 ♂ (USNM); *Meta*: Villavicencio, 21-22 Jul 71, C. J. Marinkelle (COM 529, 533), 2 ♀ (USNM); Puerto Lopes, 9 Sept 71, C. J. Marinkelle (COM 595), 1 ♀ (USNM).

ECUADOR. *Napo*, *Coca*: Apr-May 65, L. E. Pena G. (ECU 8, 91), 1 ♂, 17 ♀ (USNM). *Esmeraldas*: San Lorenzo, 14-18 Aug 72, M. E. Arzube (ECU 180), 4 ♀ (USNM).

TRINIDAD and TOBAGO. *Nariva*: "Bush Bush Forest", 27 Dec 63-16 Aug 65, TRVL personnel, 1 lp♂ (TR 7-103), 3 lp♂ (TR 16-119, 122, 123), 1 lp♀ (TR 16-118), 7 L (TR 16-108-114), 1 L (TR 16), 2 lp♀ (TR 63-144, 145), 1 lp♀ (TR 730-106), 1 L (TR 1329), 1 lp♂ (TR 1329-20); "Nariva Swamp", 4 Dec 63, M. Takahashi (LPA), 1 lp♂ (-5). *St. Andrew*: Cumoto, 5, 14 Aug 41, L. E. Rozeboom, 4 ♂ (TRR 40, 47B); Valencia, forest preserve, 29 Aug 45, W. H. W. Komp, 2 ♀ (KOH 16-38, 5-T-37); "Valencia Old Road", 1 Oct 64, A. Gurra, 1 ♀ (TR 745); "Turure Forest", Jul 66, F. Guerra, 2 ♀ (TR 1615). *St. George*: "Aqua Santa", 29 Jul 65, A. Querra, 1 lp♀ (TR (1291-10), 5 ♀ (TR 1291), 4 P (TR 1291-1); "Arena Forest Reserve", Sept 65, TRVL, 2 ♀ (TR 1431), Nov 65, TRVL, 2 ♀ (TR 1433), Dec 65, TRVL, 2 ♀ (TR 1441). (All at USNM).

VENEZUELA. Cotatumbo River, other data not available, L. H. Dunn, 1 ♂ (2194) with gen. slide (USNM); Locality not specified (VZ 429), 1 ♀ (USNM).

GUYANA. Locality unknown (BGR 5- L. E. Rozeboom leg.), 1 ♂ (USNM).

SURINAME. *Para*: Paramaribo, 26-30 Jun 64, D. C. Geijskes (SUR 82), 1 ♀ (USNM); *Brokopondo*: Zanderij, 16-22 Nov 64, D. C. Geijskes (SUR 110), 1 ♀ (USNM).

FRENCH GUIANA. *Guyane*: Cayenne, 31 Jan-4 Feb 65, T. H. G. Aitken, A. Guerra, R. Martinez (FG 15, 18, 26, 27, 29, 37, 41, 42, 43, 44, 46), 12 ♂ 44 ♀ (USNM); Remire, 13 Mar 67, J. Frederick and R. X. Schick (FG 126), 1 lp♂ (FG 126-31), 11 L (FG 126-3) (USNM); foret de Cabassou, 18 Jul-3 Sept 68, J. Clastrier (FGC 428, 429, 436, 437, 461) 8 ♂ (USNM); same locality, 18 Aug-12 Oct 67, J. Clastrier, (FGC 3239, 3241, 3257, 3261, 3263), 12 ♂ (USNM); Matoury, foret de Cogneau, 29 Apr-18 Oct 68, J. Clastrier, (FGC 3412), 1 ♂, 1 L (USNM); Regina, Kaw, 6 Mar 69, J. Clastrier (FGC 3996), 1 ♀ (USNM).

BRAZIL. *Para*: Belem, IPEAN, on Rio Guama, Reserva de Aura or APEG Forest, 27 Nov 68-20 Nov 70, T. H. G. Aitken and A. Toda, (BRB 6, 7, 9, 11, 13, 14, 15, 17, 18, 19, 22, 24, 25, 26, 27, 29, 33, 36, 40, 41, 42, 44, 45, 48, 50, 51, 54, 56, 58, 60, 61, 62, 63, 64) 146 ♂ (USNM); '74, J. F. Reinert (No. 107 136), 5 ♀ (USNM). *São Paulo*: Iguape, Porto de Ribeira, 17 Mr 76, O. S. Lopes, 1 ♂ (USNM).

TAXONOMIC DISCUSSION. As interpreted here, *pedroi* n. sp., *epanastasis* (and its synonym *pseudotaeniopus*) and *crybda* are closely related and form a distinct complex of the *Culex spissipes* group as defined by Galindo (1969).

This complex can be readily recognized by the characteristic male genitalia as described and illustrated for *pedroi* and for *pseudotaeniopus* by Galindo and Blanton (1954). The true *taeniopus* as interpreted above, apparently represents another complex with the characteristic male genitalia as illustrated and/or described for *opisthopus* in Rozeboom and Komp (1950) and Belkin, Heinemann and Page (1970). Further details on the characterization of these 2 complexes and full description of the included species based on the correlated characters of all stages will be presented in the future. For the present, the characteristics of the adults and male genitalia are summarized in the provisional keys given below.

BIONOMICS. *Culex pedroi* is one of the commonest species of *Melanoconion* in lowland swamp forests in Panama and other areas. The single larval collection from Chilibre, Rio Chagres in Panama was made at the margin of a lake under deep shade of forest at an elevation of 25 m. The water at the breeding site was stagnant, permanent with abundant floatage, tree roots and a muddy bottom. Immatures of *pedroi* were collected in association with specimens provisionally identified as *Cx. (Mel.) epanastasis* (= *crybda*), *spissipes* (Theobald), sp. near *zetki* Dyar and other undetermined *Melanoconion* species (Heinemann and Belkin 1978:173, collection number PA 1126). Numerous adults were collected biting man, from animalbaited traps, light traps and Malaise traps. In Almirante, Panama, Galindo (1969) reported that this species (as "*taeniopus*" of authors) and other related forms seem to prefer the blood of rodents but also fed on other mammals and birds, both in the forest canopy and on the ground. Ecological and virus isolation studies from natural populations and laboratory transmission experiments by the staff of the Gorgas Memorial Laboratory (Galindo et al, 1966; Galindo and Srihongse 1967; Srihongse and Galindo 1967) have shown that *pedroi* (as *taeniopus*) is important in the transmission of Venezuelan encephalitis (VE), Eastern equine encephalitis (EEE) and other arboviruses.

PROVISIONAL KEYS TO *CULEX TAENIOPUS* AND RELATED SPECIES

Adults

1. Hindtarsus without white rings at joints of tarsomere 1-5, tarsomere 5 completely dark *crybda*
Hindtarsus with white rings at joints of tarsomeres 1-4, tarsomere 5 completely white 2
- 2(1). Upper corner of sternopleuron with distinct scale patch; apex of femora of all legs without white knee spots *taeniopus*
Upper corner of sternopleuron without scale patch; apex of femora of all legs with white knee spots 3
- 3(2). *Male*: Palpal segments 2-5 with distinct basal pale bands . *epanastasis*
Male: Palpal segments 2-5 without basal pale bands . . . *pedroi* n. sp.

Male Genitalia

1. Lobes of IX tergite long, fingerlike; distal division of subapical lobe not divided (see Fig. 61 for *opisthopus* in Rozeboom and Komp (1950); Fig. 37 in Belkin, Heinemann and Page (1970)) *taeniopus*
 Lobes of IX tergite short, rounded, moundlike; distal division of subapical lobe divided 2
- 2(1). Lateral plate of aedeagus with short, simple or bifid apical tergal process; distal division of subapical lobe with specialized setae arranged in 3 separate groups (see Fig. 24 for *pseudotaeniopus* in Galindo and Blanton (1954)) *epanastasis*
 Lateral plate of aedeagus with very long, simple apical tergal process; distal division of subapical lobe with specialized setae arranged in 2 separate groups (Fig. 2 of *pedroi* n. sp.; also see Fig. 80 for "*taeniopus*" of authors in Rozeboom and Komp (1950)) . *pedroi* n. sp., *crybda*

ACKNOWLEDGMENT

We thank Ronald A. Ward for editing the manuscript and Vichai Malikul for preparing the illustrations.

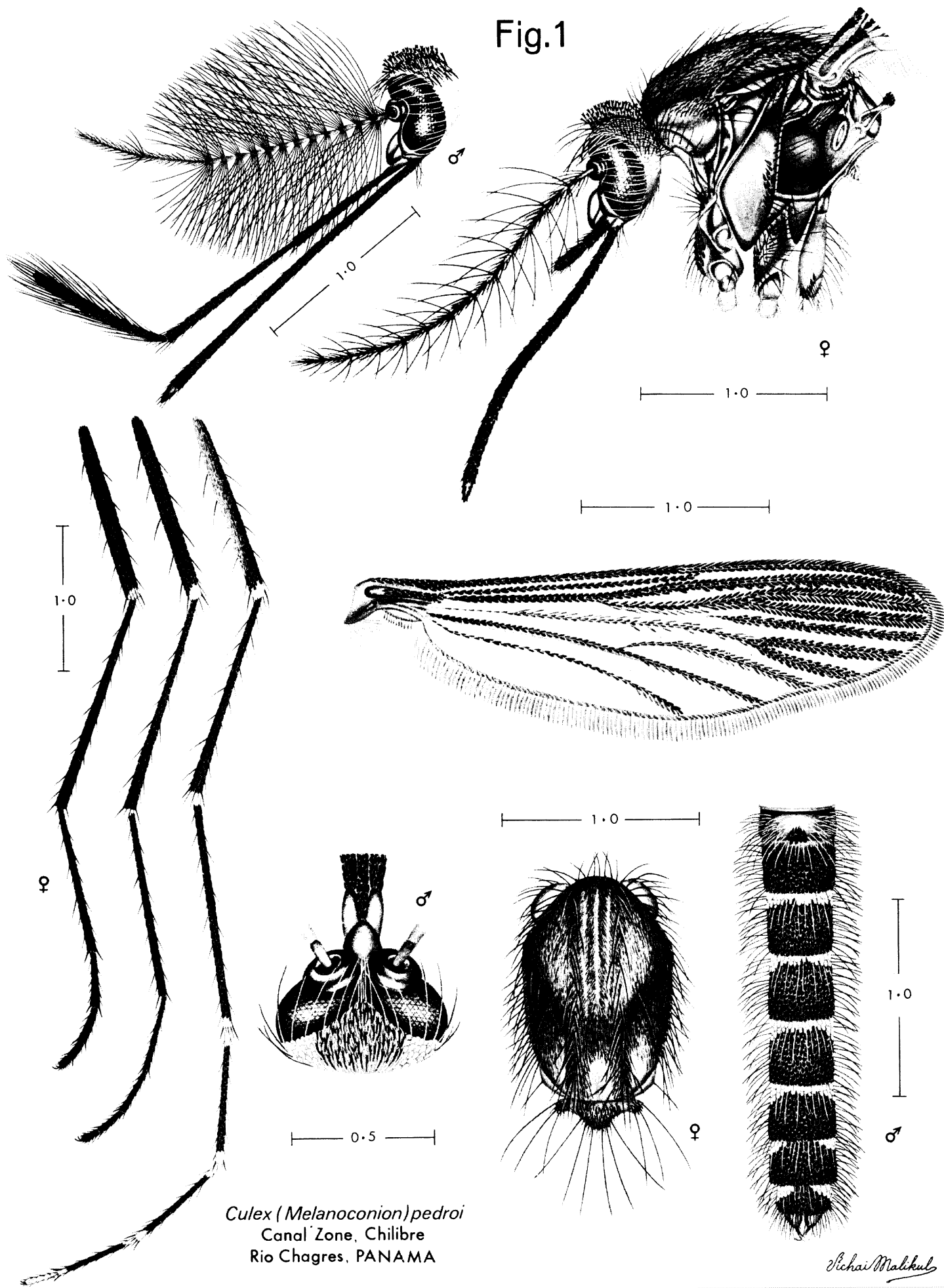
REFERENCES CITED

- Belkin, J. N., S. J. Heinemann and W. A. Page. 1970. Mosquito studies (Diptera, Culicidae) XXI. The Culicidae of Jamaica. Contr. Entomol. Inst. (Ann Arbor) 6(1):1-458.
- Belkin, J. N., R. X. Schick and S. J. Heinemann. 1965. Mosquito studies (Diptera, Culicidae) V. Mosquitoes originally described from Middle America. Contr. Entomol. Inst. (Ann Arbor) 1(5):1-95.
- Bonne, C. and J. Bonne-Wepster. 1925. Mosquitoes of Surinam. R. Colon. Inst. Amst. Afd. Trop. Hyg. 13, 558 p.
- Duret, J. P. 1953. Las especies argentinas de *Culex* (*Melanoconion*) (Diptera-Culicidae). Rev. Soc. Entomol. Argent. 16:67-76.
- _____. 1954. Las especies argentinas de *Culex* (*Melanoconion*) (Diptera-Culicidae) (Conclusión). Rev. Soc. Entomol. Argent. 16:99-121.
- Dyar, H. G. 1920. The species of *Choeroporpa*, a subgenus of *Culex* (Diptera, Culicidae). Insec. Inscit. Menst. 8:54-81.
- _____. 1922. Notes on tropical American mosquitoes (Diptera, Culicidae). Insec. Inscit. Menst. 10:188-96, 1 pl.
- _____. 1923. The mosquitoes of Panama (Diptera, Culicidae). Insec. Inscit. Menst. 11:167-86.

- Dyar, H. G. 1924. Some new mosquitoes from Colombia II (Diptera, Culicidae). Insec. Inscit. Menst. 12:183-6.
- _____. 1925. The mosquitoes of Panama (Diptera, Culicidae). Insec. Inscit. Menst. 13:101-95.
- _____. 1928. The mosquitoes of the Americas. Carnegie Inst. Wash. Publ. No. 387, 616 p., 123 pl. + Errata and Addenda.
- Dyar, H. G. and F. Knab 1907. New American mosquitoes. J. N. Y. Entomol. Soc. 15:100-1.
- Edwards, F. W. 1932. Diptera, Fam. Culicidae. In P. Wytsman, Genera Insectorum. Desmet-Verteneuil, Brussels Fasc. 194, 258 p., 5 pl.
- Foote, R. H. 1954. The larvae and pupae of the mosquitoes belonging to the *Culex*, subgenera *Melanoconion* and *Mochlostyrax*. U. S. Dept. Agri. Tech. Bull. 1091., 126 p.
- Forattini, O. P. 1965. Entomologica Medica. Culicini: *Culex*, *Aedes* e *Psorophora*. Vol. 2. São Paulo Univ. 506 p.
- Galindo, P. 1969. Notes on the systematics of *Culex* (*Melanoconion*) *taeniopus* Dyar and Knab and related species, gathered during arbovirus investigations in Panama. Mosq. Syst. News Lett. 1:82-9.
- Galindo, P. and F. S. Blanton. 1954. Nine new species of Neotropical *Culex*, eight from Panama and one from Honduras (Diptera, Culicidae). Ann. Entomol. Soc. Am. 47:231-47.
- _____. 1955. An annotated list of the *Culex* of Panama (Diptera, Culicidae). Proc. Entomol. Soc. Wash. 57:68-74.
- Galindo, P., S. Srihongse, E. De Rodaniche and M. A. Grayson. 1966. An ecological survey for arboviruses in Almirante, Panama, 1959-1962. Am. J. Trop. Med. Hyg. 15:385-400.
- Heinemann, S. J. and J. N. Belkin. 1978. Collection records of the project "Mosquitoes of Middle America" 10. Panama, including Canal Zone (PA, GG). Mosq. Syst. 10:119-96.
- Howard, L. O., H. G. Dyar and F. Knab. 1915. The mosquitoes of North and Central America and the West Indies. Systematic description (in two parts), Part I. Carnegie Inst. Wash. Publ. 159, Vol. 3, 523 p.
- Knight, K. L. and A. Stone. 1977. A catalog of the mosquitoes of the world (Diptera, Culicidae). The Thomas Say Found., Entomol. Soc. Am. Vol. 6, 611 p.
- Komp, W. H. W. 1926. A new *Culex* from Honduras. Insec. Inscit. Menst. 14:44-5.

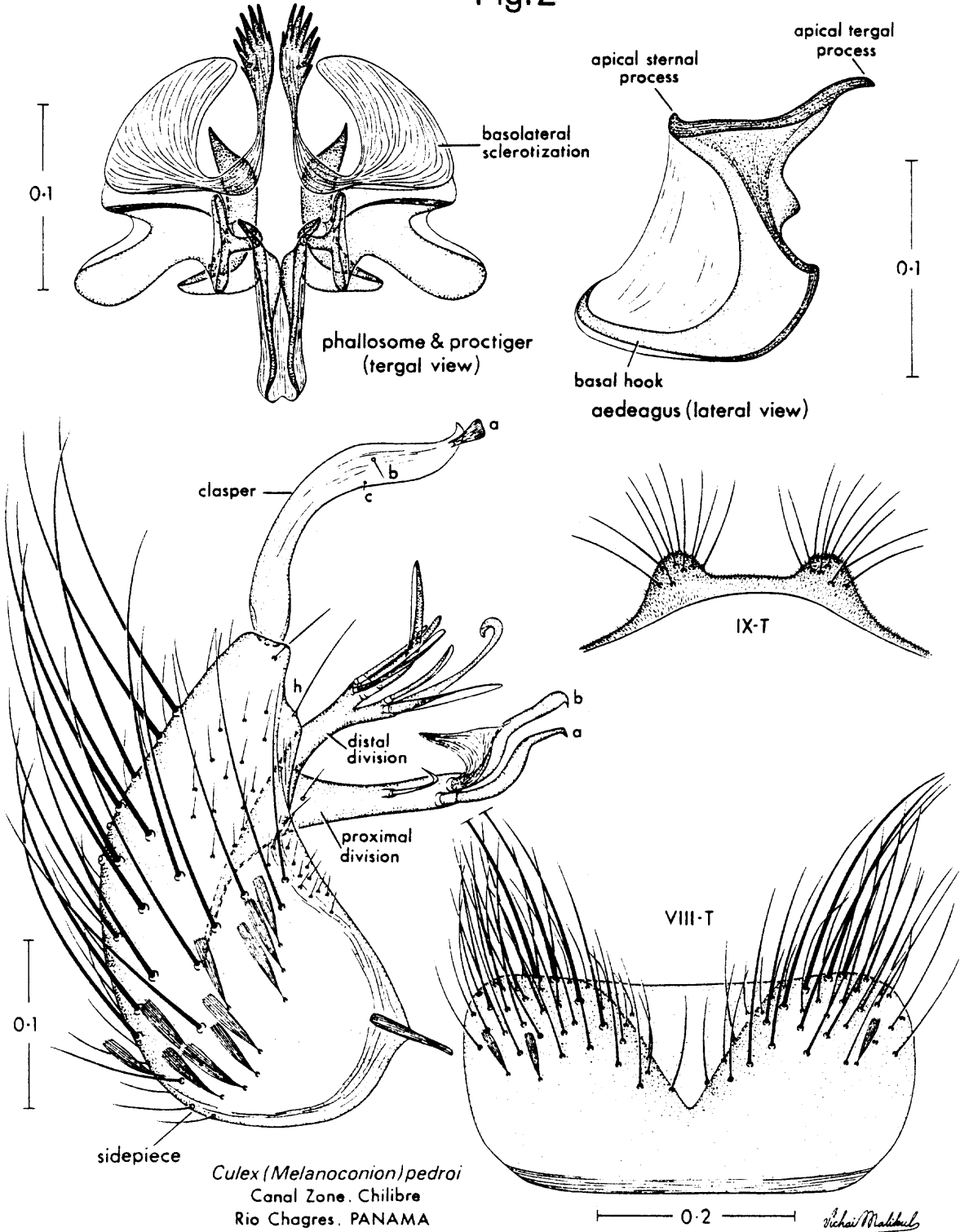
- Komp, W. H. W. 1935. Notes on the validity of the types of the species in the subgenera *Mochlostyrax* and *Melanoconion* in the U. S. National Museum (Diptera, Culicidae). Proc. Wash. Entomol. Soc. 37:1-11.
- Lane, J. 1953. Neotropical Culicidae. Vol. 1. São Paulo Univ., São Paulo, 548 p.
- Rozeboom, L. E. and W. H. W. Komp. 1950. A review of the species of *Culex* of the subgenus *Melanoconion* (Diptera, Culicidae). Ann. Entomol. Soc. Am. 43:75-114.
- Srihongse, S. and P. Galindo. 1967. The isolation of eastern equine encephalitis virus from *Culex (Melanoconion) taeniopus* Dyar and Knab in Panama. Mosquito News 27:74-6.
- Stone, A. and K. L. Knight. 1957. Type specimens of mosquitoes in the United States National Museum: IV, The genus *Culex* (Diptera, Culicidae). J. Wash. Acad. Sci. 47:42-59.
- Stone, A., K. L. Knight and H. Starcke. 1959. A synoptic catalog of the mosquitoes of the world (Diptera, Culicidae). The Thomas Say Found., Entomol. Soc. Am. Vol. 6, 358 p.

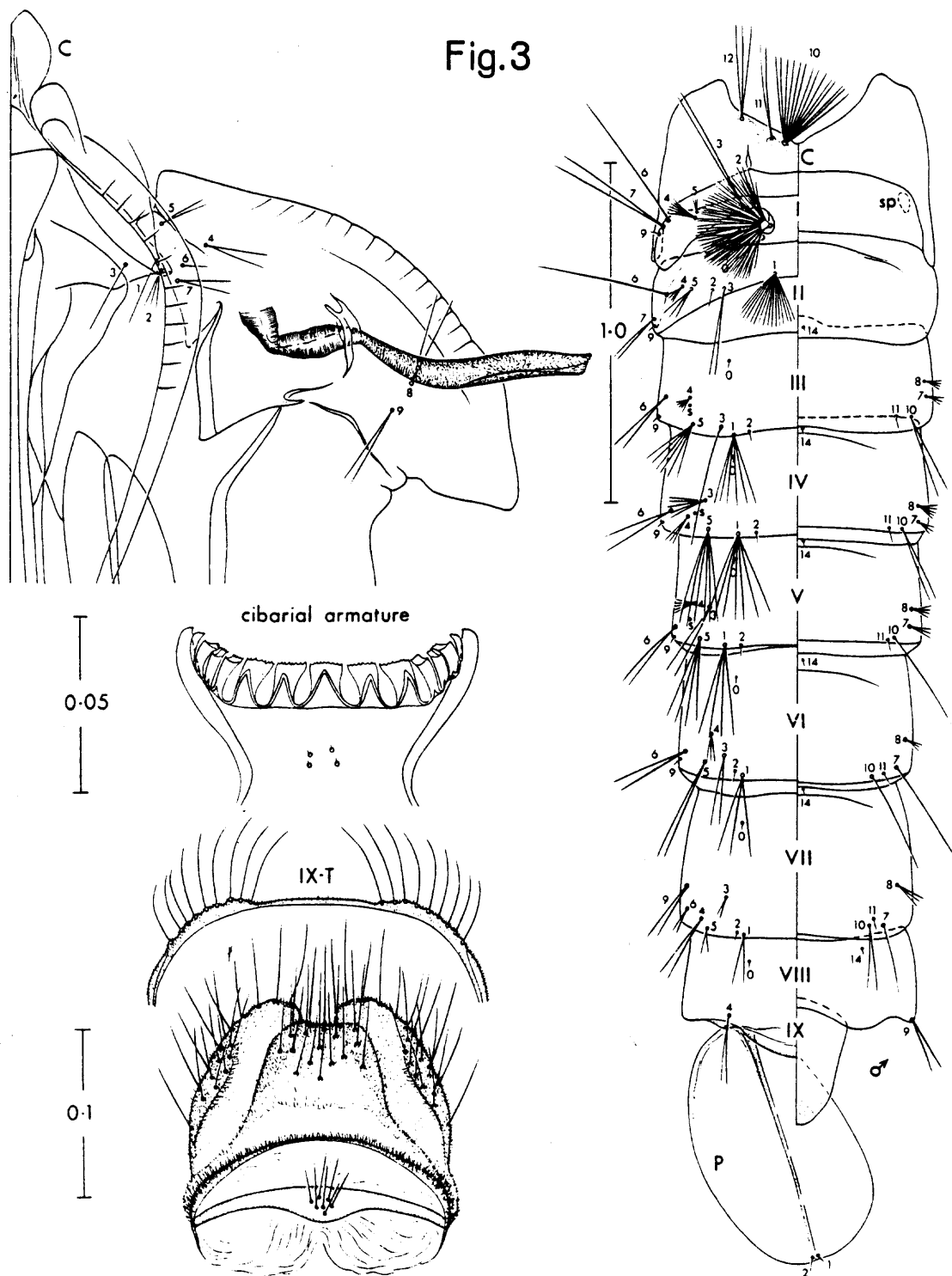
Fig.1



Culex (Melanoconion) pedroi
Canal Zone, Chilibre
Rio Chagres, PANAMA

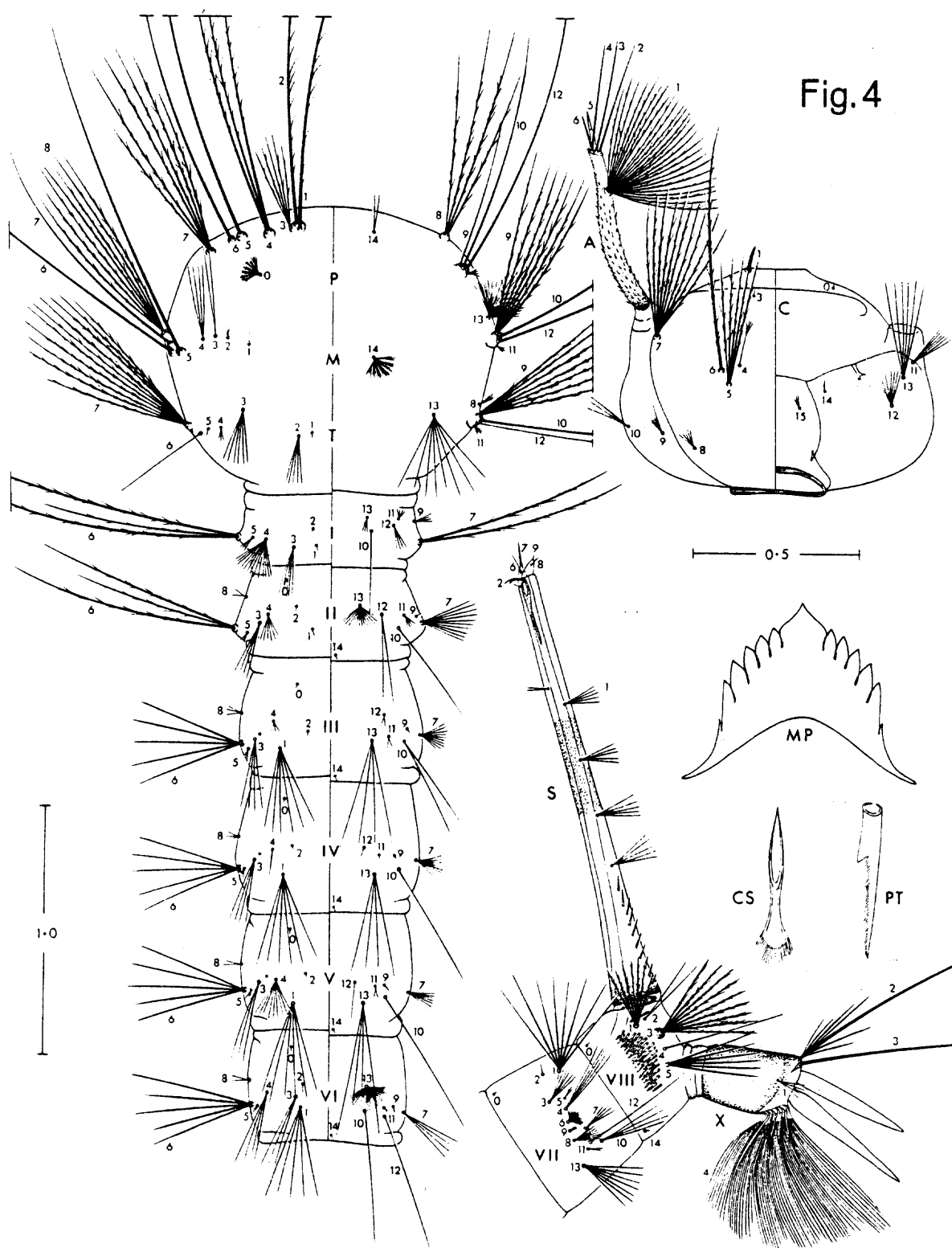
Fig. 2





Culex (Melanoconion) pedroi
Canal Zone, Chilibre
Rio Chagres, PANAMA

Sehail Malikul



Culex (Melanoconion) pedroi
Canal Zone, Chilibre
Rio Chagres, PANAMA

Rehail Malikul